

Claims

1. An apparatus for managing plasma in wafer processing operations, comprising:

a housing having an fluid entry port and a fluid exit port, the housing having an internal region defined by a top horizontal wall, a bottom horizontal wall and a circular side wall;

a plurality of baffle plates, each one of the plurality of baffle plates define a level in a multilevel structure formed in the internal region within the housing, each baffle plate being either separated from one another, or separated from either the top horizontal wall or the bottom horizontal wall by a separation spacing, each of the plurality of baffle plates including,

a plurality of holes, the plurality of holes in each of the baffle plates being oriented so that holes defined in each of the plurality of baffle plates are misaligned, thus defining a nonlinear path for fluids designed to enter the entry port, traverse each level of the multilevel structure defined by the plurality of baffle plates, and leave the exit port of the housing; and

a gas inlet port in at least one of the separating spacing, the gas inlet port configured to inject gas into the housing in at least one of the separation spacing.

2. An apparatus for managing plasma in wafer processing operations as recited in claim 1, wherein the gas inlet port is in an uppermost separation spacing.

3. An apparatus for managing plasma in wafer processing operations as recited in claim 1, wherein the gas inlet port is in a lowermost separation spacing.

4. An apparatus for managing plasma in wafer processing operations as recited in claim 1, wherein gas injected from the gas inlet port mixes with the plasma in the separation spacing.

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5. An apparatus for managing plasma in wafer processing operations as recited in claim 1, wherein the plasma and the gas flowing through the nonlinear path within the housing undergoes turbulence and mixes.

6. An apparatus for managing plasma in wafer processing operations as recited in claim 1, wherein the nonlinear path is designed to cause recombination in fluid gas traversing through the housing.

7. An apparatus for managing plasma in wafer processing operations as recited in claim 1, wherein each one of the plurality of baffle plates is circular.

8. An apparatus for managing plasma in wafer processing operations as recited in claim 1, wherein each one of the plurality of baffle plates is oriented horizontally in the housing.

9. An apparatus for managing plasma in wafer processing operations as recited in claim 1, wherein the plurality of baffle plates includes 3 baffle plates.

10. An apparatus for managing plasma in wafer processing operations as recited in claim 1, wherein each of the plurality of baffle plates provide a baffle surface area causing the increased impedance.

5 11. An apparatus for managing plasma in wafer processing operations as recited in claim 1, wherein the plasma is a downstream plasma.

12. An apparatus for optimizing plasma delivery in wafer processing operations comprising:

10 a housing configured to have a first chamber and a second chamber, the first chamber and the second chamber being separated by a wall having a plurality of orifices, the housing having an input port at a first end for supplying a plasma into the first chamber and an output port at a second end of the housing, the input port and the output port being aligned with each other, but misaligned with each of the plurality of orifices; and

15 at least one fluid input, the at least one fluid input being configured to supply fluid into at least one of the first chamber and the second chamber, the plasma supplied through the input port capable of being mixed with the supplied fluid within the at least one of the first chamber and the second chamber;

wherein the output port at the second end enables the supplied plasma mixed with the
20 fluid supply to exit the second chamber.

13. An apparatus for optimizing plasma delivery in wafer processing operations as recited in claim 12, wherein the at least one fluid input is configured to supply fluid into the first chamber.

14. An apparatus for optimizing plasma delivery in wafer processing operations as recited in claim 12, wherein the at least one fluid input is configured to supply fluid into the second chamber.

5 15. An apparatus for optimizing plasma delivery in wafer processing operations as recited in claim 12, wherein a first fluid inlet is configured to supply fluid into the first chamber and a second fluid inlet is configured to supply fluid into the second chamber.

10 16. An apparatus for optimizing plasma delivery in wafer processing operations as recited in claim 15, wherein the first fluid inlet and the second fluid inlet are managed separately and may inject fluid individually or in combination.

15 17. An apparatus for optimizing plasma delivery in wafer processing operations as recited in claim 12, wherein the plasma is a downstream plasma.

18. An apparatus for managing plasma in wafer processing operations comprising:

20 a housing configured to have an internal region that is defined by an inner wall, the housing having an input port for supplying a plasma into the housing at a first end and an output port at a second end;

a hollow tube, the hollow tube being contained in the internal region within the housing, the hollow tube being defined by a wall that extends between the first end and the

second end, the hollow tube containing a plurality of orifices that define a plurality of fluid paths through the wall; and

a fluid input, the fluid input being configured to supply fluid into the internal region of the housing, the supplied fluid capable of passing through the plurality of orifices in the wall of the hollow tube, the plasma supplied through the input port capable of being mixed within the hollow tube with the supplied fluid that enters the hollow tube through the plurality of orifices;

wherein the output port at the second end of the housing enables the mixed plasma and fluid supply to exit the housing.

19. An apparatus for managing plasma in wafer processing operations as recited in claim 18, further comprising:

a plasma generating source connected to the input port, the plasma generating source configured to produce the plasma.

20. An apparatus for managing plasma in wafer processing operations as recited in claim 18, further comprising:

a wafer processing chamber connected to the output port, the wafer processing chamber being configured to receive the mixed plasma from the output.

21. An apparatus for managing plasma in wafer processing operations as recited in claim 18, wherein turbulence is created inside the hollow tube through receipt of the supplied fluid through the plurality of orifices.

22. An apparatus for managing plasma in wafer processing operations as recited in claim 21, wherein the turbulence ensures mixing of the supplied fluid and the plasma.

5 23. An apparatus for managing plasma in wafer processing operations as recited in claim 18, wherein the plasma is a downstream plasma.

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